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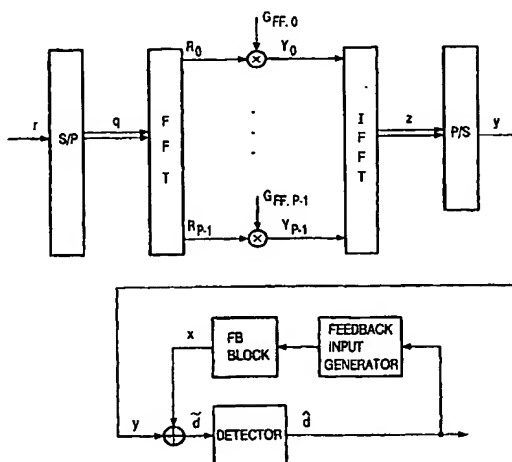
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- Published:**
- with international search report
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: **FREQUENCY-DOMAIN EQUALIZATION FOR SINGLE CARRIER SIGNALS**



(57) Abstract: Disclosed is a frequency-domain decision feedback equalizing method and device for single carrier modulation, preferably for use in a broadband communication system, wherein in a first section a fast Fourier transformation is performed on a first vector of signals (9) inputted, and as a result a second vector of signals is (R₀,...,R_{p-1}) provided, a feed forward equalization is performed by multiplying each of the components of said second vector of signals with equalization parameters (G_{ff,0},...,G_{ff,p-1}), and as a result a third vector of signals (Y₀,...,Y_{p-1}) is provided, an inverse fast Fourier transformation is performed on said third vector of signals, and as a result a fourth vector of signals (2) is provided, and an output signal (4) of said first section is provided on the basis of said fourth vector of signals; and in a second section a linear feedback filtering of a signal derived from an output signal (d) of said second section is performed, and a filtered signal (x) is provided, said filtered signal is added to said output signal (y) of said first section, and an added signal (d) is provided, and said output signal (d) of said second section is generated by extracting samples from said added signal (d).



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3 June 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 03/03839

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L25/03

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2002/070796 A1 (GAY-BELLILE OLIVIER ET AL) 13 June 2002 (2002-06-13) paragraph [0052] - paragraph [0063] figure 5	1-10, 12, 18-27 11, 28
X A	----- US 6 052 702 A (PALICOT JACQUES ET AL) 18 April 2000 (2000-04-18) cited in the application abstract column 5, line 59 - column 6, line 49 figures 4-6 ----- -/--	1-10, 12, 18-27 11, 28

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the International filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the International filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the International search

2 December 2003

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24. 03. 2004

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 03/03839

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SARI H ET AL: "TRANSMISSION TECHNIQUES FOR DIGITAL TERRESTRIAL TV BROADCASTING" IEEE COMMUNICATIONS MAGAZINE, IEEE SERVICE CENTER, PISCATAWAY, N.J, US, vol. 33, no. 2, 1 February 1995 (1995-02-01), pages 100-109, XP000505677 ISSN: 0163-6804 page 102, right-hand column, line 1 - page 104, right-hand column, line 26 figure 3	1-12, 18-28
A	----- US 6 219 378 B1 (WU SONG) 17 April 2001 (2001-04-17) column 3, line 27 - line 47 column 9, line 57 - column 10, line 26 figure 6	1,11,18, 28
P,X	----- BENVENUTO N ET AL: "BLOCK ITERATIVE DFE FOR SINGLE CARRIER MODULATION" ELECTRONICS LETTERS, IEE STEVENAGE, GB, vol. 38, no. 19, 12 September 2002 (2002-09-12), pages 1144-1145, XP006019079 ISSN: 0013-5194	1-3,9, 10,12, 18-20, 26,27
P,A	page 1144, left-hand column, line 37 - right-hand column, line 23 figure 1 -----	4-8,11, 21-25,28

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 03/03839

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-12, 18-28

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-12 18-28

Frequency-domain equalization

2. claims: 13-17 29-32

Modulation with organization of data in blocks

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 03/03839

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002070796 A1	13-06-2002	CN 1394432 T WO 0233964 A1 EP 1332613 A1	29-01-2003 25-04-2002 06-08-2003
US 6052702 A	18-04-2000	FR 2738694 A1 DE 69602962 D1 DE 69602962 T2 EP 0848866 A1 WO 9709781 A1	14-03-1997 22-07-1999 07-10-1999 24-06-1998 13-03-1997
US 6219378 B1	17-04-2001	NONE	